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AUTHOR Bezeau, Lawrence M.
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ABSTRACT

This paper examines the level and inequality of annual per pupil expenditure in the public school systems of the United States and Canada as a function of the centralization of financing. The effect of centralized revenue collection was tested empirically using a sample consisting of the American states and Canadian provinces, while controlling for federal jurisdiction and northern state or territory. It was found that centralization had no effect at all on the level of per pupil expenditure but that relatively less wealthy jurisdictions had more centralized systems. Centralization appeared to reduce the inequality of per pupil expenditure but the magnitude of the effect was small. The centralization variables accounted for only 7 percent of the variance in the coefficient of variation of per pupil expenditure. One of the control variables, annual per capita personal income, had a strong relationship with the level, but not with the variation, of per pupil expenditure. Each additional dollar of personal income per capita resulted in an additional 20 cents of per pupil expenditure. (Author/TE)

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Level and Inequality of Per Pupil Expenditure as a Function of Finance Centralization

by

Lawrence M. Bezeau

Faculty of Education

University of New Brunswick

Fredericton, New Brunswick

Canada E3B 6E3

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ABSTRACT

Level and Inequality of Per Pupil Expenditure as a Function of Finance Centralization

This paper examines the level and inequality of annual per pupil expenditure in the public school systems of the United States and Canada as a function of centralization of financing. The effect of centralized revenue collection was tested empirically using a sample consisting of the American states and Canadian provinces, while controlling for federal jurisdiction and northern state or territory. It was found that centralization had no effect at all on the level of per pupil expenditure but that relatively less wealthy jurisdictions had more centralized systems. Centralization appeared to reduce the inequality of per pupil expenditure but the magnitude of the effect was small. The centralization variables accounted for only seven percent of the variance of the coefficient of variation of per pupil expenditure. One of the control variables, annual per capita personal income, had a strong relationship with the level of per pupil expenditure but was not related to the variation of per pupil expenditure. Each additional dollar of personal income per capita resulted in an additional 20 cents of per pupil expenditure.

Level and Inequality of Per Pupil Expenditure as a Function of Finance Centralization

This paper examines the level and inequality of annual per pupil expenditure in the public school systems of American states and Canadian provinces as a function of the degree of centralization of financing. In recent decades many states and provinces have assumed a greater share of the financial burden of operating schools frequently with the intention of reducing expenditure disparities among school districts. In other cases the intent has been to increase the amount of financial resources available for education across a state or province. Unfortunately there is very little evidence to suggest that centralization will achieve either of these objectives. As well there are funding methods available that do not involve centralization and that have the same objectives. There are competing theoretical positions, outlined below, as to whether centralization will increase or decrease the level of expenditure.

Nevertheless, centralization of funding, especially full state assumption, has frequently been perceived as a panacea for interdistrict inequality. Several examples illustrate this. In 1963 in the Province of New Brunswick, the Byrne Commission (Byrne, Andrews, Boudreau, Nadeau, and Wilson, 1963)

recommended that the Province assume all local costs of education. This recommendation was implemented in 1967 making New Brunswick the second full-state assumption jurisdiction in North America. In 1969 the United States Advisory Commission on Intergovernmental Relations decided that full state financing was the most likely way to attain equal educational opportunity. In 1972 in the State of New York, the Fleischmann Commission (The Fleischmann report, 1973) recommended that the State move to full state assumption over a period of three years. This recommendation has not yet been implemented and appears unlikely to be implemented in the near future.

There has been some comment from the academic community on full state assumption but as Benson (1975, p. 7) acknowledges, currently available examples may not be very instructive. Much of this comment is necessarily speculative. After examining various funding schemes other than full state assumption, Cooper (1971, p. 351) concluded that "Unless our national conscience can come to tolerate a proliferation of enclaves of educational privilege alongside enclaves of underprivilege, we must move in the direction of state assumption of the full costs of elementary and secondary education.". The few empirical studies of full state assumption jurisdictions indicate that even centralization taken to its logical extreme has not entirely eliminated inequity (Hight, 1974).

This study has both a theoretical and a practical purpose. On a practical level, we need to know if centralization has achieved the objectives that decision-makers expected. Is it positively related to higher expenditures levels and greater equality of expenditure? On a theoretical level the study addresses the question of which of the two theories best explains the empirical results. The spill-over model, in particular, has recently been employed to explain economic and financial phenomena in the area of education. This is a departure from its traditional role of explaining relatively pure public goods such as defence and justice.

This study employed cross-sectional data for the 1979-80 school year to explore the two relationships posed above. In practice the centralization of revenue collection is often accompanied by other changes which frequently include the centralization of control and administration; but only the issue of finance is addressed here. In particular, issues of allocative efficiency, community preferences, local control, and organizational accommodation are not dealt with. These issues are discussed to a limited extent in Wallschlaeger (1973) and Johns (1973).

Competing Models of Centralization

Two theoretical models produce opposite predictions of the effect of centralization of revenue collection on the level of per pupil expenditure. The spillover model predicts that higher per pupil expenditure will result from greater centralization while the personal service model predicts higher expenditure as a consequence of greater decentralization. Centralization is often seen as a means of obtaining greater equality of per pupil expenditure but there are financing systems designed to achieve the same result without centralization.

The model which is here referred to as the spillover model is based on the presumed public-good properties of education (Brazer, 1970). Education is assumed to have benefits that cannot be captured by the individual receiving the education. These are difficult to specify but may include good citizenship, neighborliness, lowered propensity to commit crimes, national unity, social cohesion, and more effective raising of children. Society as a whole receives these benefits and the individual responsible for the benefit cannot charge others for his or her contribution. Since educated individuals do not receive all the benefits of their education, if they are left to finance their education from their own resources they will underinvest. Milton Friedman (1962, pp.

85-107) refers to these benefit spillovers as neighborhood effects and uses them to justify some government intervention in financing education. To prevent such underinvestment the community must organize, impose taxes on itself, and subsidize education; as most communities do.

Although the community receives the public benefits of the individual's education, it may not be the same community as the one that subsidized this education. Some of the benefits accrue to the larger community: the state or nation. Also individuals are geographically mobile; they may leave the local community that educated them, depriving it of the public benefits of their education. Individuals are not as likely to leave their state of origin and even less likely to leave their country. Thus, many of the benefits that are external to the local community are internal to the state or nation. The benefits that arise from costs borne in a given jurisdiction that are external to the jurisdiction are called benefit spillovers. Education benefit spillovers discourage a jurisdiction from investing in education. States and nations, because they are able to internalize a higher proportion of the benefits, can be expected to invest more heavily in education. Thus we would expect to find those states and provinces with greater state or provincial and federal financial involvement

to spend more on education and those with greater local school board financial involvement to spend correspondingly less.

A recent study by Hadley (1985) employed the spill-over model with American states to predict that educational expenditure would be affected by migration patterns in and out of the individual states. He controlled for per capita income and found that this variable had a very strong effect on per pupil expenditure but that the migration variables made no significant difference. He re-analysed the data of an earlier study that had reached the opposite conclusion and found that the apparently contradictory results were caused by a high correlation between migration rates and per capita income which made it difficult to distinguish between the two.

The personal service model assumes that education is something that individuals will invest in more heavily if they can invest in themselves or in their local community rather than in a larger aggregate. This model has most frequently been used to characterize health services and to explain low service levels in countries with government-financed health insurance. Individuals are believed to be more willing to spend money on their own health than on the health of the nation as a whole.

Hickrod (Final Report, 1973, p. 105), in a dissenting note to a report recommending full state assumption for the State of

Illinois, described a mechanism whereby decentralized revenue collection may contribute to higher levels of per pupil expenditure. Wealthier districts increase their expenditures which motivates the educational community to pressure state governments into helping the poorer districts to catch up with them. With full state assumption this mechanism would disappear, perhaps causing the state to construe uniformity as adequacy.

Lake (1982, 1983) implicitly applied the personal service model to education in suggesting that full state assumption in the Province of New Brunswick has reduced the sufficiency of education finance in comparison with Nova Scotia. His sample of only four jurisdictions did not permit him to test this hypothesis but he and others before him have noted low per pupil expenditures in full state assumption jurisdictions.

With respect to the effect of centralization on equality of per pupil expenditure, there are expectations that the way to reduce inequality is to centralize revenue collection at the state or provincial level and to hand out the revenue equitably without regard to local ability to pay. It is nevertheless possible to equalize the ability to pay without centralization. Revenue sharing schemes such as guaranteed valuation, percentage equalizing, and, especially, district power equalizing permit equalization of the ability to finance

education without necessarily centralizing revenue collection (Jargowsky, Moskowitz, and Sinkin; 1977). Using a power equalizing approach, it is possible, in theory at least, to achieve complete interdistrict equality of financial ability without any state or provincial contribution at all. This is done through recapture provisions with redistribution of recaptured revenue in such a way that a simple relationship exists between the district choice of tax rate and a level of per pupil expenditure, a relationship that is the same for all districts in the jurisdiction. The level of per pupil expenditure is determined only by the willingness of the district to tax itself and not by its ability to pay.

Sample

The unit of analysis is the highest sub-national jurisdiction, the state in the United States and the province in Canada. Because of the similarity of education finance in the two countries, the states and provinces were analysed together whenever data availability permitted. Both countries are federations with the states and provinces as the governmental units constitutionally responsible for education. Much of this responsibility has been delegated to locally-elected school boards which have the authority to levy a tax on real property in most states and provinces. In both

countries the federal government makes categorical grants to elementary and secondary education but this is the level which provides the least amount of money.

The two countries together provided a sample size of 62 jurisdictions. This included all American states and the District of Columbia. The District of Columbia was treated as a school district without a state and Hawaii, the only full-state-assumption jurisdiction in the United States, as a state without school districts. All ten Canadian provinces were included but the two Canadian territories were lumped together as one jurisdiction. The two full-state-assumption jurisdictions in Canada, New Brunswick and Prince Edward Island, have systems of school districts and so were treated normally.

Data were obtained from published and unpublished sources, the National Center for Education Statistics in the United States and from Statistics Canada in Canada. NCES provided data disaggregated by school board whereas financial data for individual boards were not available for Canada. This prevented the calculation of inequality measures for Canadian provinces. All 62 jurisdictions are included in the level of expenditure analysis but only 49 American jurisdictions are included in the inequality analysis. Of the American jurisdictions, the District of Columbia and Hawaii were excluded from the

inequality analysis because, without two or more school districts, it is impossible to calculate a measure of inequality.

Methodology

Multiple linear regression was used for both the level of expenditure analysis and the inequality analysis. The dependent variable in the level-of-expenditure analysis was the pupil-weighted mean of annual per pupil expenditures of school districts in each jurisdiction. The dependent variable in the inequality analysis was the pupil-weighted coefficient of variation of this mean. Per pupil expenditure was defined as total recurrent expenditure exclusive of food services and transportation, which corresponds to the National Center for Education Statistics concept of core current expenditure. The coefficient of variation was calculated by dividing the weighted standard deviation by the weighted mean. Although numerous other measures of inequality are possible, the voluminous literature on this topic (Sen, 1973; Love & Wolfson, 1976; Bezeau, 1979) suggests that the coefficient of variation is free of the undesirable properties that characterize many popular measures while being relatively easy to understand and explain. In the calculation of these measures, the several hundred school boards in North America that send all their

students to other boards for education were excluded in order to avoid double counting. All dollars amounts used were current and were expressed in United States dollars for both countries.

The independent variables were classified as control variables and experimental or centralization variables. The control variables were federal jurisdiction, northern jurisdiction, and annual personal income per capita. The centralization variables were proportions of revenue provided by the local, the state or provincial, and the federal levels.

In general, the control variables describe phenomena that are likely to influence the dependent variables but are logically and temporally prior to them. Federal jurisdiction was used to control for the higher average per pupil expenditure in Canada. The northern jurisdiction variable controlled for the much higher per pupil expenditure in the Canadian territories and Alaska. Annual personal income per capita was used as a measure of the ability of the jurisdiction to finance education. In studies reviewed by Hadley (1985), this variable is shown to be superior in predicting educational expenditures than other related ones such as income per child in public school.

The three centralization variables must be classified as representing centralization or decentralization in order to

structure the regression equations and interpret the results. Because of the minimal level of participation of the federal level in both countries, centralization is seen primarily as a question of local versus state or provincial contribution. The state proportion, therefore, represents centralization and the federal proportion must also represent centralization. This leaves the local proportion to represent decentralization. Since the three proportions add to one it was not possible to enter all of them into one regression equation. Local proportion was entered into the first equation and state and federal proportion were entered into the second equation.

The regressions were unweighted, the rationale for this being that the independent variables of concern, the centralization variables, characterize jurisdictions rather than pupils, revenue amounts, or populations. Because of this, caution must be exercised in interpreting some of the descriptive statistics. The arithmetic means in the tables are averages across jurisdictions. To obtain a revenue proportion for Canada and the United States together, for example, it would be necessary to weight each jurisdiction's proportion by the total revenue for education of that jurisdiction. This was not done. Likewise to obtain the mean per pupil expenditure for all pupils in the sample it would be necessary to weight each jurisdiction's per pupil expenditure by the number of pupils.

Additional analyses, not reported here, were performed using several non-linear models and various standard variable transformations. These analyses included the calculation of elasticities. In no case were the results superior to those produced by the relatively simple linear model reported here.

Level of Expenditure Results

Results for annual per pupil expenditure as the dependent variable are given in Tables 1 and 2. First order

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Insert Table 1 here.

Insert Table 2 here.

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relationships are examined first as they provide information which is required to interpret the regression results. The control variables show the expected correlation with the dependent variable; northern and Canadian jurisdictions have a higher annual per pupil expenditure and those with a higher per capita personal income spend significantly more on education. Unexpectedly, personal income correlates strongly with two of the centralization variables. Local proportion correlates positively with personal income and state proportion correlates negatively. We can conclude that those states and provinces with lower personal income per capita are the ones that have

chosen to centralize education finance. The wealthy jurisdictions have retained decentralized systems. In view of the fact that the wealthy jurisdictions also spend more on education it is of crucial importance in the regression analysis to control for some measure of wealth before judging the effect of the centralization variables on per pupil expenditure.

The federal proportion, which averages less than ten percent, is not related to personal income but the overall correlation coefficient hides important differences between the two countries. The coefficient for personal income for the United States is -0.41, suggesting a federal policy of using categorical grants for education for equalization purposes. The coefficient of 0.04 for Canada indicates no such policy. Federal proportion has a significant negative correlation with per pupil expenditure even though the state and local proportions do not correlate at all with this variable.

The signs on the regression coefficients in Table 2 are consistent with the personal service model but the standard errors of the centralization variables are far too high to permit this conclusion or the opposite conclusion. The regression itself is highly significant with almost eighty percent of the variance in per pupil expenditure predicted by the independent variables but the three control variables

(NORTH, USA, and PINC) account for slightly more than 79 percent leaving less than one-half percent for the centralization variables. An examination of regression results and residuals for individual jurisdictions supports the conclusion forced upon us by the regression equations, that centralization of revenue collection or the lack of it has no effect on the level of per pupil expenditure.

Personal income per capita accounts for 28 percent of additional variance after the entry of NORTH and USA. An additional dollar of personal income per capita results in about 20 additional cents of per pupil expenditure. In the case of the comparison between New Brunswick and Nova Scotia, the only variables that differ are the personal income and centralization variables. Using the regression equation, Nova Scotia's higher per capita personal income produces a per pupil expenditure difference of 128 dollars. The actual difference is only 75 dollars. The difference in per pupil expenditure between the two provinces is more than explained by the difference in wealth. This contradicts Lake's hypothesis described earlier.

Inequality of Expenditure Results

Table 3 shows somewhat weaker first order

Insert Table 3 here.

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relationships for the coefficient of variation analysis than were found for the level of expenditure analysis. Personal income per capita correlates positively with the coefficient of variation. While this relationship is statistically significant, it is not strong. None of the three centralization variables show significant relationships with the coefficient of variation.

The coefficient of variation of per pupil expenditure proved to be much more difficult to predict with the variables used here than was the level of expenditure. Although both the regressions reported in Table 4 are significant, less than

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Insert Table 4 here.

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36 percent of the variance is predicted in each case. NORTH shows a strong positive relationship to the coefficient of variation but the relationship between personal income per capita and the coefficient of variation is small and insignificant.

The regression coefficients on the centralization variables suggest that greater centralization is associated with greater equality but the effect is small. Local proportion of revenue has a positive relationship with the coefficient of variation which reaches significance at the 0.05 level. The state proportion of revenue has a negative coefficient which just fails to reach significance at that level. The federal proportion is unrelated to the coefficient of variation.

The magnitude of the centralization effect on the coefficient of variation is not great. A reduction of ten percentage points in the local share reduces the coefficient of variation by 0.018 which is less than one-fifth of a standard deviation. If Oregon, the jurisdiction with the second highest coefficient of variation, reduced its local proportion of 0.57 to zero this would reduce its coefficient of variation from 0.49 to 0.39. This would only change its coefficient of variation rank from second to fourth.

The two control variables account for 29 percent of the variance in the coefficient of variation while the centralization variables contribute an additional seven percent. Although this seven percent is statistically significant, centralization of revenue collection cannot be recommended as a policy intended to reduce expenditure

inequality among school districts when 93 percent of the variance will be unaffected by whatever policy changes are made. An inspection of individual cases confirms that centralized revenue collection is neither a necessary nor a sufficient condition for equality of per pupil expenditure.

Conclusions

The empirical results do not support either the spillover model or the personal service model of education. Centralization of revenue collection does not consistently increase or decrease per pupil expenditure but those jurisdictions with lower per capita personal income have chosen in disproportionate numbers to centralize their education finance systems. This may have given the impression that centralization leads to lower expenditure. Per pupil expenditure is well predicted by annual per capita personal income but after controlling for this variable, the centralization variables show no relationship with per pupil expenditure. Any government policy which is intended to increase the adequacy of education finance can ignore this variable altogether.

These results combine with those of Hadley (1985) to cast doubt on the usefulness of the spill-over model in explaining the finance and supply of education. The success of this model

in explaining the provision of relatively pure public goods has not been duplicated for education. There are several possible reasons. To start with there are the substantial private benefits of education exemplified by the higher incomes of educated persons and their generally better working conditions. Another possible factor is the embodiment, in the educated individual, of the investment in his or her education. Traditional public goods such as defense are not embodied in individuals in this way.

The importance of per capita personal income as a predictor of per pupil expenditure has been confirmed by this study. Each additional dollar of personal income resulted in an additional 20 cents of per pupil expenditure.

Centralization of revenue collection leads to more equality of per pupil expenditure among school districts but the magnitude of this effect is not impressive. The centralization variables account for only seven percent of the variance of the coefficient of variation. For this reason, centralized revenue collection by itself cannot be recommended to political decision-makers as a means of achieving greater equality.

Additional research needs to be done to account for the 65 percent of the variance in the inequality of per pupil expenditure which is not accounted for in the research reported

here. Equality of opportunity continues to be an important policy variable but the research results currently available on the determinants of expenditure inequality are not very helpful to policy-makers.

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Table 1

Descriptive Statistics and Correlation Coefficients for Annual Per Pupil Expenditure and all Independent Variables for Sixty-two American and Canadian Jurisdictions

Descriptive Statistics

Variable Name	Mean	Standard Deviation	Description of Variable
PPEX	1958.954	514.317	Annual per pupil expenditure
NORTH	0.032	0.178	Northern state or territories Alaska and Can. territories = 1.0 Others = 0.0
USA	0.823	0.385	Federal jurisdiction USA = 1.0; Canada = 0.0
PINC	8934.050	1474.880	Personal income per capita
LOPR	0.399	0.188	Local proportion of revenue
STPR	0.506	0.195	State proportion of revenue
FDPR	0.095	0.049	Federal proportion of revenue

Correlation Coefficients

	PPEX	NORTH	USA	PINC	LOPR	STPR
NORTH	0.712					
USA	-0.151	-0.154				
PINC	0.611	0.236	0.394			
LOPR	0.026	-0.278	0.421	0.431		
STPR	0.053	0.304	-0.552	-0.407	-0.968	
FDPR	-0.312	-0.143	0.579	-0.036	0.010	-0.259

$|r| > 0.211$ is significant at the 0.05 level.

$|r| > 0.296$ is significant at the 0.01 level.

Table 2

Regression Results for Annual Per Pupil Expenditure as Predicted by Local, State, and Federal Proportions of Revenue for Sixty-two American and Canadian Jurisdictions

Regression Results with Local Proportion of Revenue

Multiple R	0.890	R squared	0.793
F value	54.495	Significance of F	0.0000

Standard error of estimate 242.239

Variable Name	B Coefficient	Standard Error	Beta Coefficient	Signif. of coef.
NORTH	1563.784	201.715	0.5416	0.0000
USA	-432.291	93.297	-0.3237	0.0000
PINC	0.204	0.027	0.5838	0.0000
LOPR	168.964	207.731	0.0617	0.4194
(CONSTANT)	378.022	198.526		0.0619

Dependent variable is PPEX

Regression Results with State and Federal Proportions of Revenue

Multiple R	0.891	R squared	0.794
F value	43.168	Significance of F	0.0000

Standard error of estimate 243.635

Variable Name	B Coefficient	Standard Error	Beta Coefficient	Signif. of coef.
NORTH	1559.378	203.014	0.5401	0.0000
USA	-383.458	125.048	-0.2872	0.0033
PINC	0.200	0.028	0.5725	0.0000
STPR	-140.153	214.543	-0.0530	0.5163
FDPR	-650.642	841.656	-0.0615	0.4427
(CONSTANT)	573.269	316.017		0.0750

Dependent variable is PPEX

Table 3

Descriptive Statistics and Correlation Coefficients for Coefficient of Variation of per Pupil Expenditure and all Independent Variables for Forty-nine American Jurisdictions

Descriptive Statistics

Variable Name	Mean	Standard Deviation	Description of Variable
CV	0.195	0.096	Coefficient of variation of annual per pupil expenditure
NORTH	0.020	0.143	Northern state Alaska = 1.0; others = 0.0
PINC	9118.900	1291.027	Personal income per capita
LOPR	0.437	0.155	Local proportion of revenue
STPR	0.458	0.137	State proportion of revenue
FDPR	0.105	0.039	Federal proportion of revenue

Correlation Coefficients

	CV	NORTH	PINC	LOPR	STPR
NORTH	0.535				
PINC	0.248	0.427			
LOPR	0.116	-0.236	0.235		
STPR	-0.099	0.281	-0.082	-0.972	
FDPR	-0.118	-0.045	-0.647	-0.570	0.361

$|r| > 0.238$ is significant at the 0.05 level.

$|r| > 0.332$ is significant at the 0.01 level.

Table 4

Regression Results for Coefficient of Variation of Annual per Pupil Expenditure as Predicted by Local, State, and Federal Proportions of Revenue for Forty-nine American Jurisdictions

Regression Results with Local Proportion of Revenue

Multiple R	0.596	R squared	0.355
F value	8.251	Significance of F	0.0002

Standard error of estimate 0.079

Variable Name	B Coefficient	Standard Error	Beta Coefficient	Signif. of coef.
NORTH	0.432	0.096	0.6447	0.0000
PINC	-7.132E-06	1.063E-05	-0.0962	0.5056
LOPR	0.180	0.082	0.2912	0.0342
(CONSTANT)	0.173	0.090		0.0598

Dependent variable is CV

Regression Results with State and Federal Proportions of Revenue

Multiple R	0.596	R Squared	0.355
F value	6.067	Significance of F	0.0006

Standard Error of estimate 0.080

Variable Name	B Coefficient	Standard Error	Beta Coefficient	Signif. of coef.
NORTH	0.429	0.098	0.6400	0.0001
PINC	-5.386E-06	1.383E-05	-0.0727	0.6988
STPR	-0.189	0.096	-0.2704	0.0550
FDPR	-0.094	0.436	-0.0383	0.8311
(CONSTANT)	0.332	0.160		0.0439

Dependent variable is CV